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Cacciotti

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(54) **MACHINE TOOL MOUNTED MIST COLLECTOR WITH FILTER CLAMP**

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(60) Provisional application No. 61/407,445, filed on Oct. 28, 2010.

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B01D 46/00 (2006.01)

B01D 50/00 (2006.01)

B01D 45/08 (2006.01)

B01D 46/10 (2006.01)

(52) **U.S. Cl.**

CPC **B01D 50/002** (2013.01); **B01D 45/08** (2013.01); **B01D 46/0031** (2013.01); **B01D 46/10** (2013.01); **B01D 46/0036** (2013.01)

(58) **Field of Classification Search**

CPC B01D 46/10; B01D 46/2411

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55/485; 95/90, 268, 287; 96/117.5, 140,

96/417, 421

See application file for complete search history.

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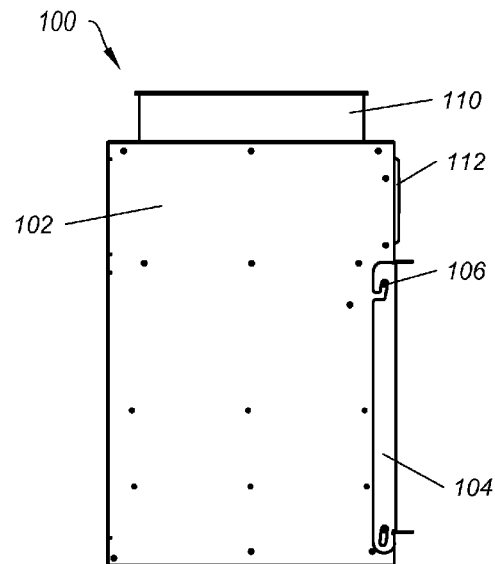
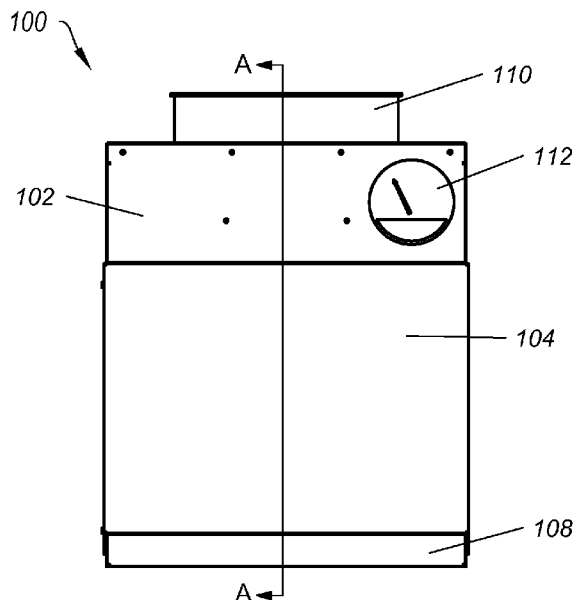
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ABSTRACT

A system for removing cooling liquid from a mist. The system includes an intake, where the intake is configured to receive the cooling mist and a baffle filter including a plurality of overlapping and offset layers of baffles, the baffle filter configured to collect and output cooling liquid from the cooling mist. The system also includes a mesh positioned vertically above the baffle and configured to drip cooling liquid collected thereon onto the baffle filter and an air filter, where the air filter is configured to remove a portion of pollutants from the demisted air. The system further includes a filter clamp configured to hold the air filter in place and an exhaust, where the exhaust is configured to output the demisted air.

20 Claims, 6 Drawing Sheets



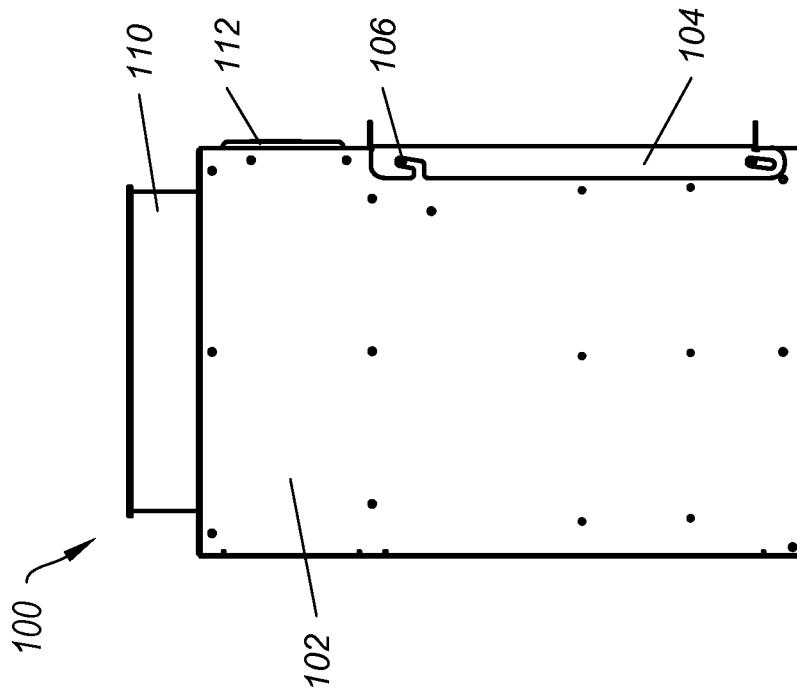


FIG 1B

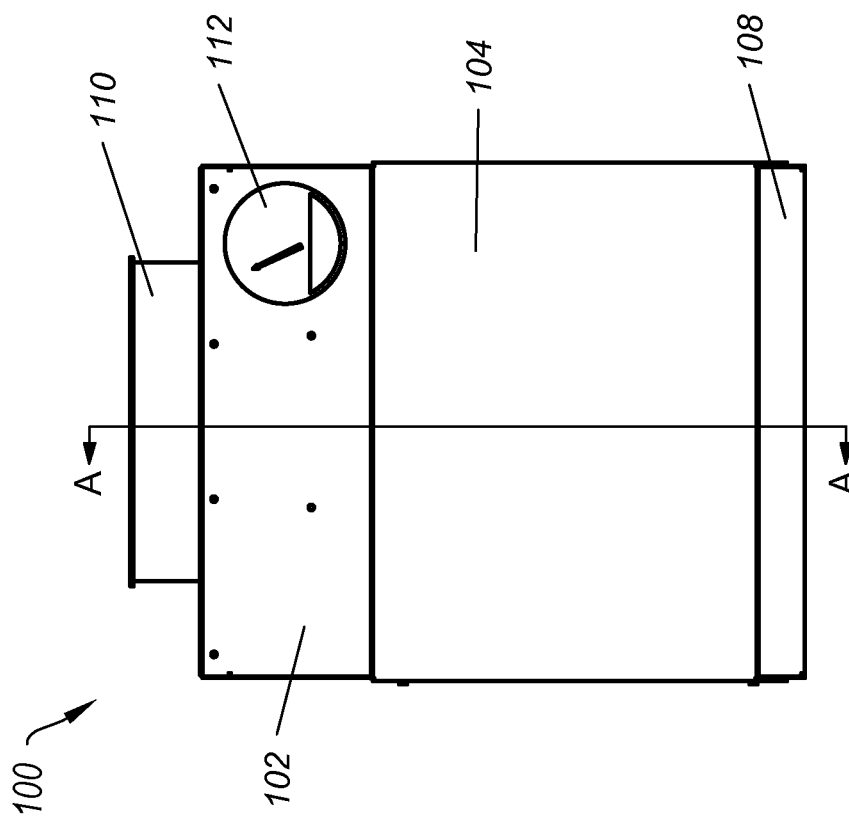


FIG 1A

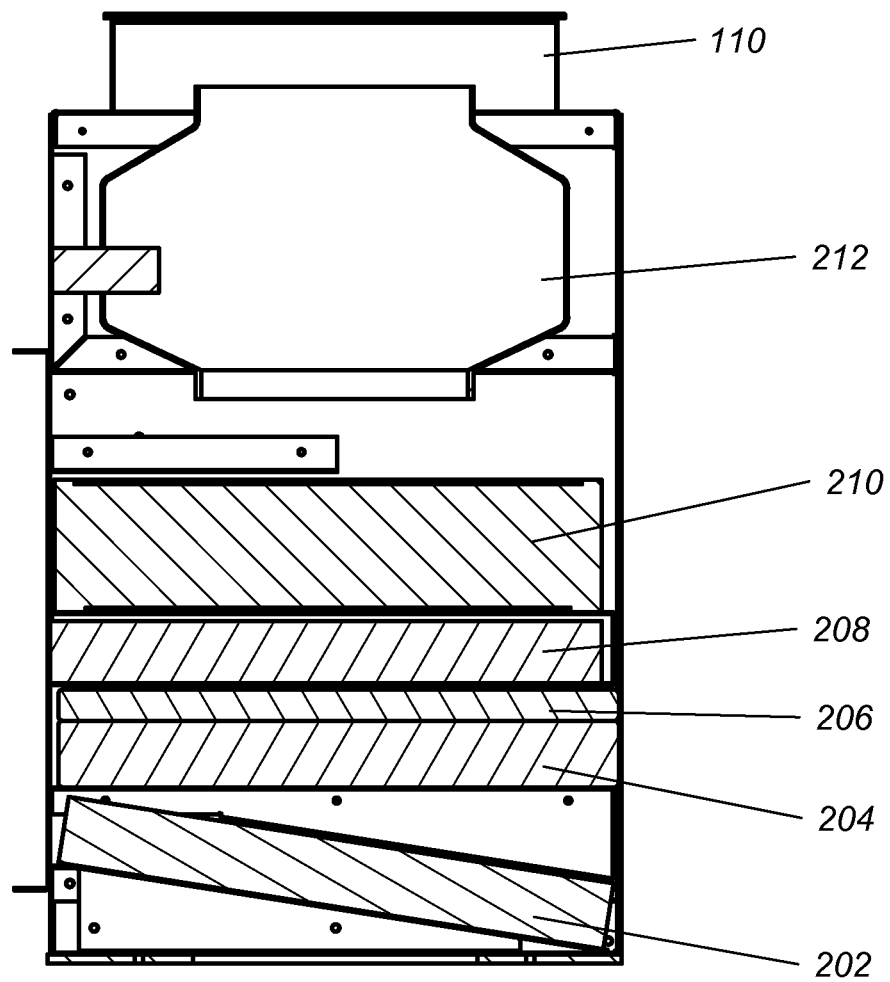


FIG 2

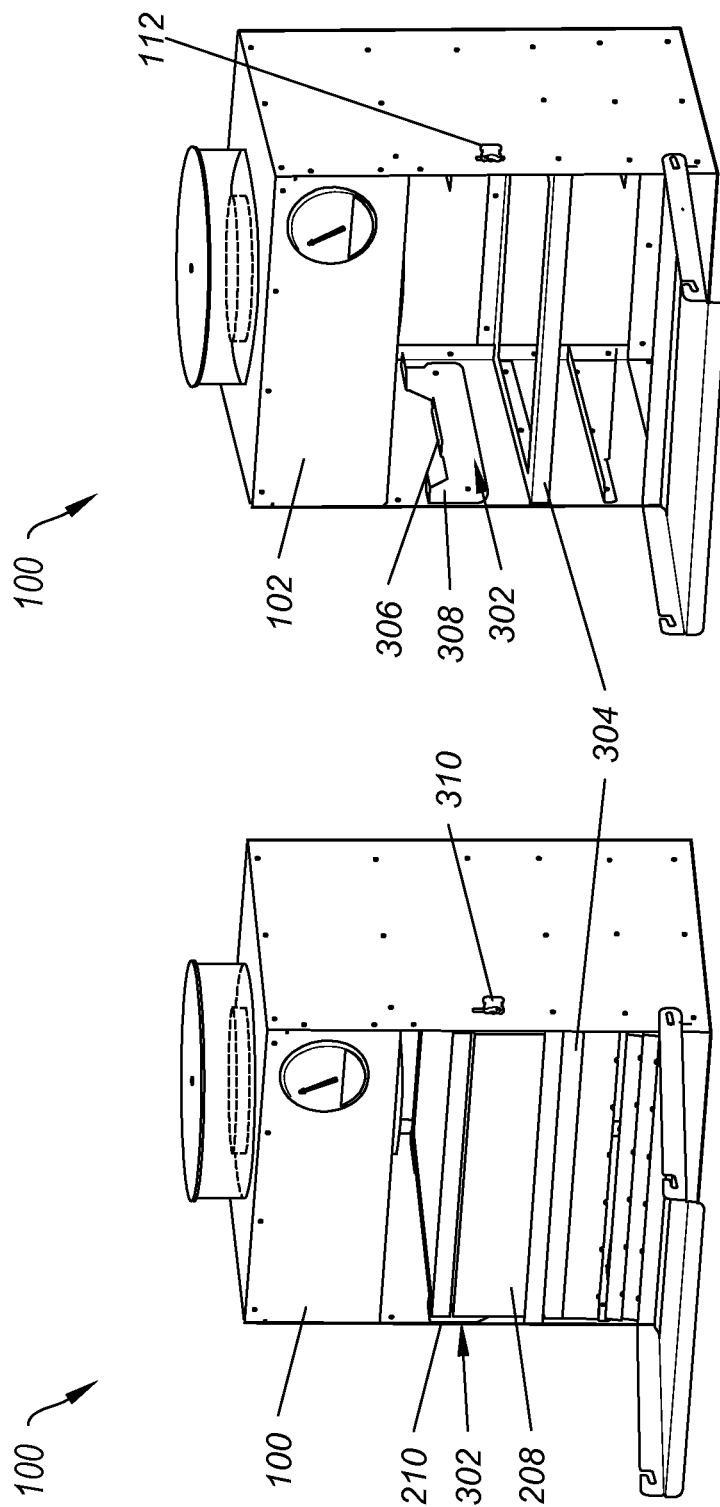


FIG 3B

FIG 3A

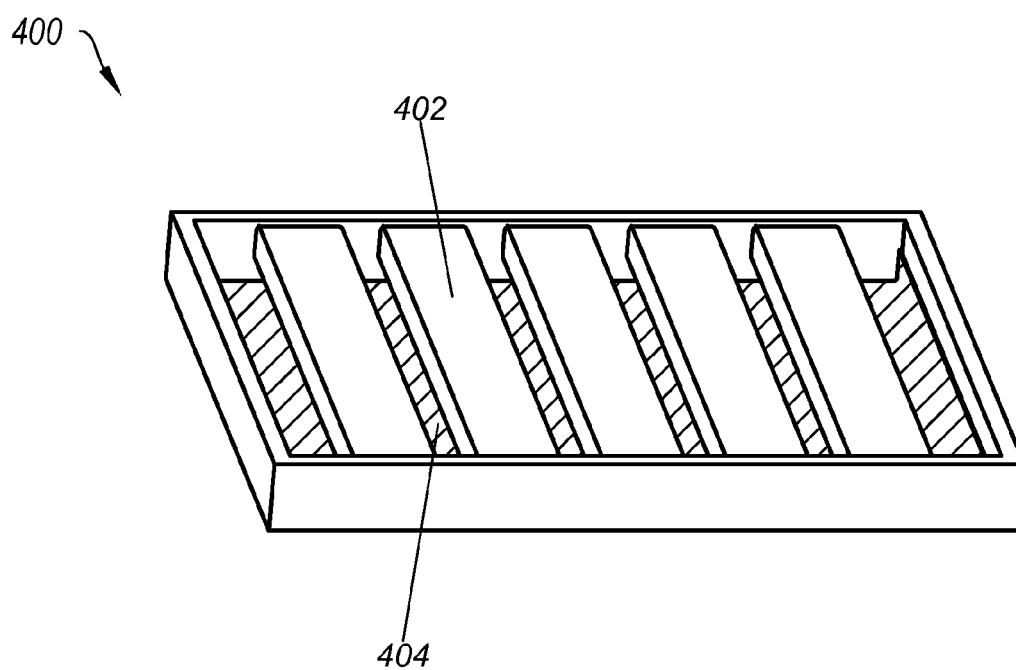


FIG 4

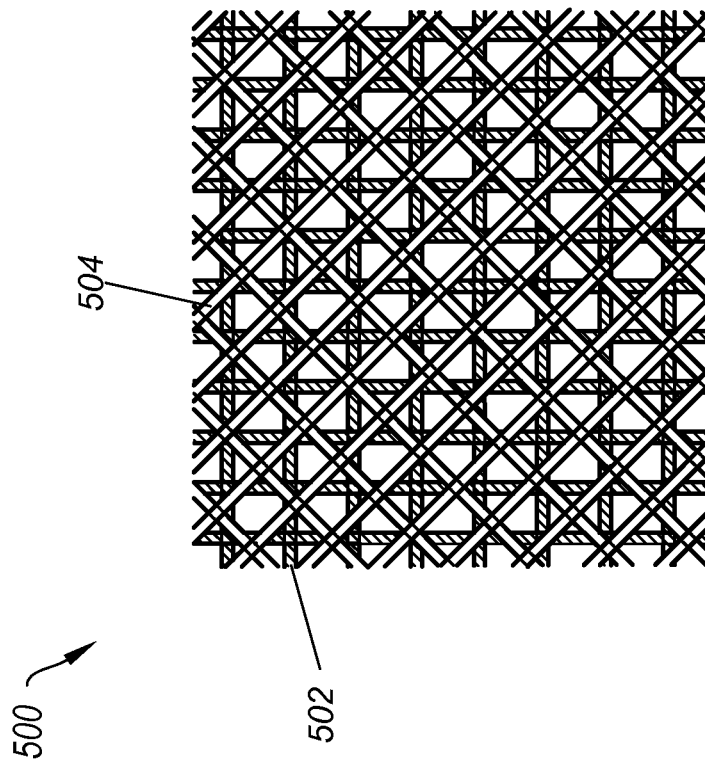


FIG 5

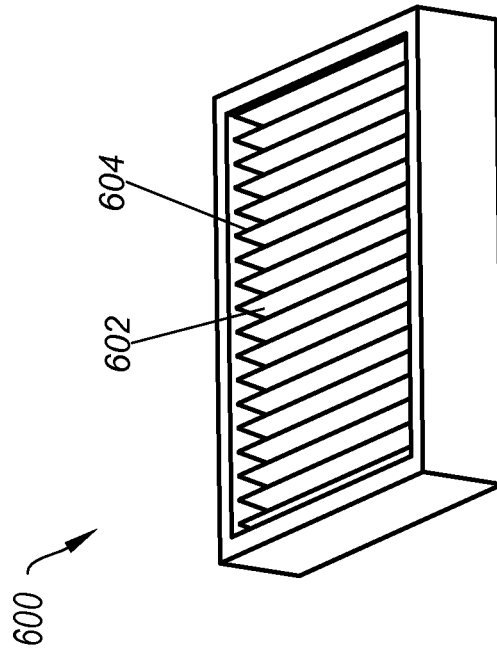
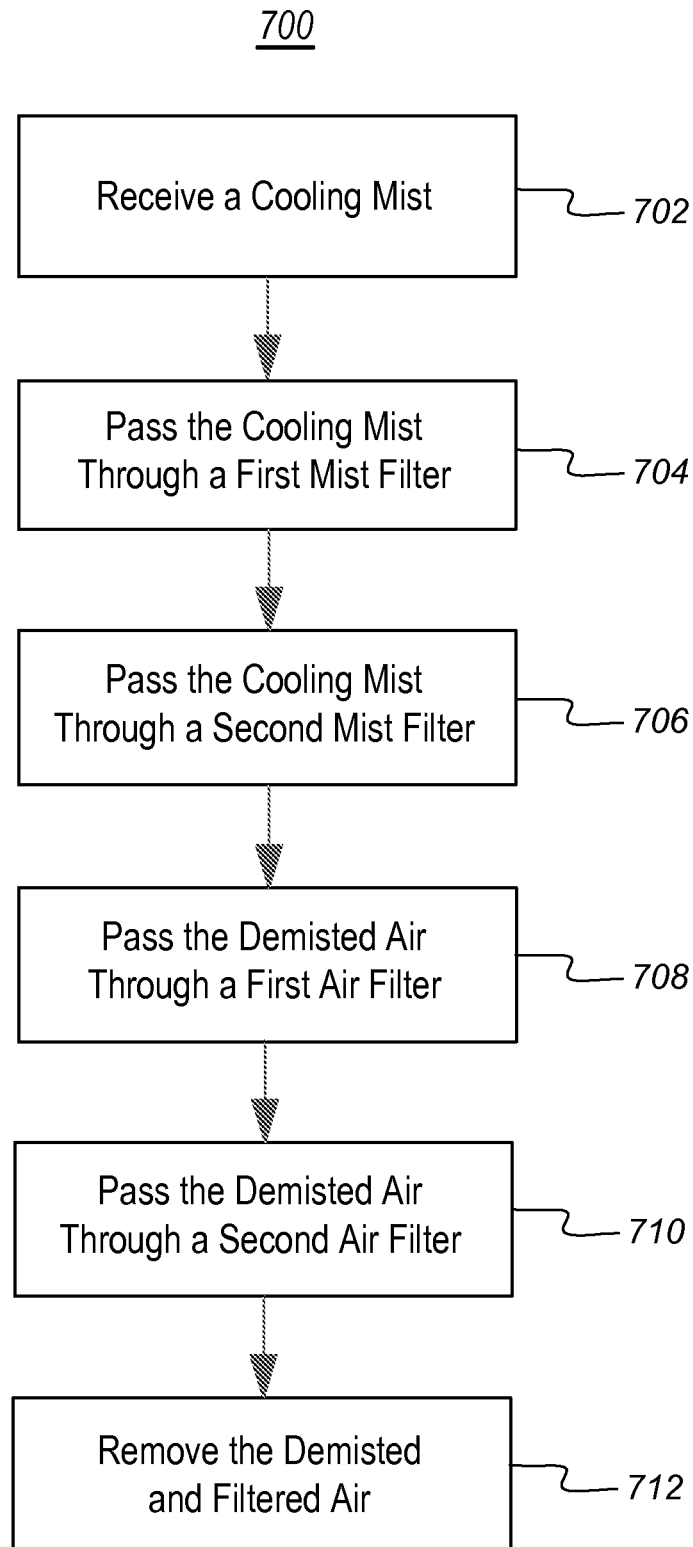


FIG 6

**FIG. 7**

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**MACHINE TOOL MOUNTED MIST
COLLECTOR WITH FILTER CLAMP****CROSS-REFERENCE TO RELATED
APPLICATIONS**

This application is a continuation-in-part of, and claims the benefit of and priority to, U.S. Non-Provisional patent application Ser. No. 13/283,467 filed on Oct. 27, 2011, which application is incorporated herein by reference in its entirety.

U.S. Non-Provisional patent application Ser. No. 13/283,467 claims the benefit of and priority to U.S. Provisional Patent Application Ser. No. 61/407,445 filed on Oct. 28, 2010, which application is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

Cooling liquid is commonly used with machine tools. These tools may produce a high rate of motion or rotation. As the tool interacts with a work material, the high rate of motion may lead to high amounts of frictional heating. This heating may damage the tool, the work material or both. To prevent this damage a cooling liquid is often circulated over the tool and work material. The circulating cooling liquid removes the heat, preventing unwanted damage.

Nevertheless, there are a number of drawbacks associated with the use of cooling liquid. In particular, the motion of the tool tends to scatter the cooling liquid. I.e., the stream of cooling liquid is disrupted and broken up into droplets. This can result in cooling liquid causing a large mess in the immediate area.

In addition, it can make it more difficult to recover the cooling liquid. I.e., the cooling liquid is recirculated over and over, repeatedly dissipating the frictional heat. However, the disruption of the cooling liquid stream can result in loss of cooling liquid. This can lead to a loss of efficiency as the cooling liquid may not be given sufficient time to be cooled before being recirculated. Further, it can lead to greater expense as the cooling liquid needs to be replaced.

Moreover, the scattered droplets may be suspended in the air. These droplets can form a mist if enough droplets are formed. This cooling mist can enter air intakes of the machine tool or other machines in the nearby area, which can foul the operation of the machines. In addition, it can be inhaled by workers in the immediate area, causing respiratory or other health problems.

Accordingly, there is a need in the art for a system that can remove the cooling liquid droplets from the mist. In addition, there is a need in the art for the system to collect the cooling liquid. Further, there is a need in the art for the system to allow the cooling liquid to be recirculated.

**BRIEF SUMMARY OF SOME EXAMPLE
EMBODIMENTS**

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential characteristics of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

One example embodiment includes a system for removing cooling liquid from a mist. The system includes an intake, where the intake is configured to receive the cooling mist and a baffle filter including a plurality of overlapping and offset layers of baffles, the baffle filter configured to collect and

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output cooling liquid from the cooling mist. The system also includes a mesh positioned vertically above the baffle and configured to drip cooling liquid collected thereon onto the baffle filter and an air filter, where the air filter is configured to remove a portion of pollutants from the demisted air. The system further includes a filter clamp configured to hold the air filter in place and an exhaust, where the exhaust is configured to output the demisted air.

Another example embodiment includes a system for removing cooling liquid from a mist. The system includes a housing and a fan, where the fan is configured to move air through the system. The system moreover includes an intake, where the intake is configured to allow a cooling mist from the exterior of the housing to enter the interior of the housing where the cooling mist includes cooling liquid droplets suspended in air. The system also includes a mist filter, where the mist filter is configured to remove the cooling liquid from the mist. The mist filter includes a first mist filter, where the first mist filter is configured to remove a portion of the cooling liquid from the cooling mist and a second mist filter, where the second mist filter is configured to remove the majority of the remaining cooling liquid from the cooling mist and drip the removed cooling liquid onto the first mist filter. The system further includes an absorbent layer configured to absorb unrecoverable oil in the demisted air and an air filter. The air filter includes a first air filter, where the first air filter is configured to remove a portion of pollutants from the demisted air and a second air filter, where the second air filter is configured to remove a portion of the pollutants not removed by the first air filter. The system additionally includes a filter clamp configured to hold the air filter in place relative to the housing. The filter clamp includes a sealing surface configured to secure a first surface of the first air filter and a clamping bar configured to press a second surface of the first air filter, pressing the first air filter against the sealing surface. The filter clamp also includes a slot configured to receive the second air filter and a lock configured to secure the clamping bar in place. The system moreover includes an exhaust, where the exhaust is configured to output the demisted air.

Another example embodiment includes a method for removing cooling liquid from a cooling mist. The method includes receiving a cooling mist, where the cooling mist includes cooling liquid droplets suspended in air and passing the cooling mist through a first mist filter, where the first mist filter removes a portion of the cooling liquid droplets from the air. The method also includes passing the cooling mist through a second mist filter, where the second mist filter removes a second portion of the cooling liquid droplets from the air to generate demisted air and dripping the second portion of the cooling liquid droplets onto the first mist filter. The method further includes outputting the first and second portions of the cooling liquid droplets from the first mist filter and passing the demisted air through an air filter. The air filter removes a portion of a desired pollutant from the demisted air and is secured using a filter clamp configured to hold the first air filter in place. The method additionally includes outputting the demisted and filtered air.

These and other objects and features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

To further clarify various aspects of some example embodiments of the present invention, a more particular

description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. It is appreciated that these drawings depict only illustrated embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

FIG. 1A illustrates a front view of a mist collector;

FIG. 1B illustrates a side view of the mist collector;

FIG. 2 illustrates a cross-sectional view of the mist collector through the line A-A of FIG. 1A;

FIG. 3A illustrates the example of a mist collector with a filter clamp with filters installed;

FIG. 3B illustrates the example of a mist collector with a filter clamp with filters removed;

FIG. 4 illustrates an example of a baffle filter;

FIG. 5 illustrates an expanded view of an example of a mesh filter;

FIG. 6 illustrates an example of an air filter; and

FIG. 7 is a flow chart illustrating a method of removing a cooling liquid from a mist.

DETAILED DESCRIPTION OF SOME EXAMPLE EMBODIMENTS

Reference will now be made to the figures wherein like structures will be provided with like reference designations. It is understood that the figures are diagrammatic and schematic representations of some embodiments of the invention, and are not limiting of the present invention, nor are they necessarily drawn to scale.

FIGS. 1A and 1B (collectively "FIG. 1") illustrate an example of a mist collector 100. FIG. 1A illustrates a front view of the mist collector 100; and FIG. 1B illustrates a side view of the mist collector 100. In at least one implementation, the mist collector 100 can collect cooling liquid from a cooling mist. In particular, many tools use a cooling liquid that is applied to either the work surface or some portion of the tool. The cooling liquid is configured to remove the heat caused by friction during the machining process. The machining process can, in turn, throw droplets of the cooling liquid into the air, creating a mist. For example, the cooling liquid can include water, antifreeze, oils, water soluble oil or any other desired cooling liquid.

FIG. 1 shows that the mist collector 100 can include a housing 102. In at least one implementation, the housing 102 can surround and protect the other elements of the exercise system 100. In particular, the housing 102 can be configured to ensure that the other elements of the exercise system 100 are in the proper position relative to one another.

FIG. 1 also shows that the mist collector 100 can include a door 104. In at least one implementation, the door 104 can allow access to a portion of the interior of the housing 102. I.e., the door 104 can include a portion of the housing 102 which is movable or removable and allows a user to access the interior of the housing 102.

FIG. 1 further shows that mist collector 100 can include an attachment 106. In at least one implementation, the attachment 106 is configured to attach the door 104 to the housing 102. In particular, the attachment 106 can seal the connection between the door 104 and the housing 102, preventing unwanted air flow through the door 104 during operation. For example the attachment 106 can include one or more fasteners, such as screws, magnets, angled slots and pins or any other desired fastener. Additionally or alternatively, the

attachment 106 can include one or more hinges which allow the door 104 to move relative to the housing 102.

FIG. 1 additionally shows that the mist collector 100 can include an intake 108. In at least one implementation, the intake 108 can allow cooling mist to enter the housing 102. I.e., the intake 108 can pull cooling mist into the housing, where the cooling liquid will be removed from the cooling mist, as discussed below. Additionally or alternatively, the collected cooling liquid can pass back through the intake 108 to be used by the tool again.

FIG. 1 also shows that the mist collector 100 can include an exhaust 110. In at least one implementation, the exhaust 110 can allow clean air to exit the mist collector 100. I.e., the mist collector 100 will take in cooling mist through the intake 108, and pump out clean air, with the cooling liquid removed, through the exhaust 110. The exhaust 110 can connect to the machine tool, can be vented to the outdoors, or can be vented into the tool room, as desired by the user.

FIG. 1 further shows that the mist collector 100 can include a gauge 112. In at least one implementation, the gauge 112 can indicate the current state of one or more components within the mist collector 100. I.e., the gauge 112 can indicate to a user whether one or more components of the mist collector 112 are operating correctly and/or need to be replaced. For example, the gauge 112 can include a manometric gauge. A manometric gauge is a device used to measure positive, negative and differential pressures. A manometric gauge includes two air ports separated by a diaphragm. Pressure acting on the diaphragm of the gauge moves the indicating pointer. The movement of the pointer is relayed and amplified through a magnetic linkage. As the filter portions of the mist collector 100 become clogged, the pressure differential can increase. When the gauge measures a high enough pressure differential, one or more of the filters may need to be replaced.

FIG. 2 illustrates a cross-sectional view of the mist collector 100 through the line A-A of FIG. 1A. In at least one implementation, the mist collector 100 is configured to receive air that contains cooling mist. The mist collector 100 can remove the cooling liquid from the cooling mist, which can be returned to the machine tool, and any other pollutants in the air. The mist collector 100 can then exhaust clean air.

FIG. 2 shows that the mist collector 100 can include a first mist filter 202. In at least one implementation, the first mist filter 202 can include any desired material. For example, the first mist filter 202 can include plastic or metal. The first mist filter 202 can collect larger mist particles. I.e., the first mist filter 202 can collect large droplets from the cooling mist. For example, the first mist filter 202 can include a baffle filter. A baffle filter can include a series of baffles that the cooling mist must pass through. Because there is not a straight line through the filter, larger particles are unable to make the turns required by the air flow and collect on the baffles.

In at least one implementation, the first mist filter 202 can be inclined relative to a horizontal position. Inclining the first mist filter 202 can allow the larger droplets which have been collected to travel down the filter, where they are collected and reused as cooling liquid for the machine tool.

FIG. 2 also shows that the mist collector 100 can include a second mist filter 204. In at least one implementation, the second mist filter 204 can include any desired material. For example, the second mist filter 204 can include plastic or metal. The second mist filter can collect smaller mist particles. I.e., particles which are small enough to remain in the air flow and pass through the first mist filter 202 are collected by the second mist filter 204. The second mist filter 204 can be inclined similar to the first mist filter 202, allowing the collected cooling liquid to drain. Additionally or alternatively,

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the second mist filter **204** can be horizontal. Any droplets collected can form drops where collected which are allowed to drip onto the first mist filter **202** then collected and returned to the machine tool.

The second mist filter **204** can include any filter configured to receive smaller mist droplets. For example, the second mist filter **204** can include a mesh filter. In at least one implementation, a mesh filter can include one or more mesh layers. Mesh consists of semi-permeable barrier made of connected strands of material. I.e., mesh includes material with very small openings. As the cooling mist passes through the mesh filter, the cooling mist collects on the strands of material. Mesh layers can be offset relative to one another, eliminating straight lines of air flow. The more mesh layers present, the more droplets collected and the less droplets allowed to pass through the mesh filter; however, more mesh layers decrease the air flow through the mesh filter increasing the required pressure to circulate the cooling mist.

FIG. 2 further shows that the mist collector **100** can include a pre-filter **206**. In at least one implementation, the pre-filter **206** can absorb any remaining cooling fluid within the air. I.e., the pre-filter **206** can be configured to ensure that any non-recoverable cooling fluid is also removed from the air. For example, the pre-filter **206** can include cloth or other material which will absorb the cooling fluid. For example, the pre-filter **206** can include a pad made of cotton, polyester or any other desired material.

FIG. 2 further shows that the mist collector **100** can include a first air filter **208**. In at least one implementation, the first air filter **208** can be configured to remove one or more pollutants from the air. For example, the first air filter **208** can include a carbon filter. Carbon filtering is a method of filtering that uses a piece of activated carbon to remove contaminants and impurities, utilizing chemical adsorption. Activated carbon, also called activated charcoal, activated coal or carbo activatus, is a form of carbon that has been processed to make it extremely porous and thus to have a very large surface area available for adsorption. One pound (454 g) of activated carbon contains a surface area of approximately 100 acres. A carbon filter can be utilized to remove odors from the demisted air.

FIG. 2 additionally shows that the mist collector **100** can include a second air filter **210**. In at least one implementation, second air filter **210** can remove additional air pollutants. For example, the second air filter **210** can include a particulate air filter. A particulate air filter is a device composed of fibrous materials which removes solid particulates such as dust, pollen, mold, and bacteria from the air. A particulate air filter can include foam, pleated paper, cotton, cloth or spun fiberglass filter elements. Additionally or alternatively, the second air filter **210** can include an ionizing filter. An ionizing filter, or ioniser, uses fibers or elements with a static electric charge, which attract dust particles.

One of skill in the art will appreciate that the first air filter and the second air filter can be combined with one another. For example, an ionizing filter may be able to remove both odor particles and larger particles from the air. Additionally or alternatively, the number of filters may be increased as needed to remove other pollutants or particles from the air.

FIG. 2 also shows that the mist collector **100** can include a fan **212**. In at least one implementation, a fan is a machine used to create flow within the air. I.e., the fan **212** creates an air flow that draws cooling mist into the mist collector **100** through the first mist filter **202**, the second mist filter **204**, the first air filter **208**, the second air filter **210** and out the exhaust **110**.

FIGS. 3A and 3B (collectively "FIG. 3") illustrate an example of a mist collector **100** with a filter clamp **302**. FIG.

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3A illustrates the example of a mist collector **100** with a filter clamp **302** with filters installed; and FIG. 3B illustrates the example of a mist collector **100** with a filter clamp **302** with filters removed.

FIG. 3 shows that the filter clamp **302** can include a sealing surface **304**. The sealing surface **304** is configured to ensure that all air passes through the first air filter **208**. I.e., the sealing surface **304** is sealingly attached to the sides and door to prevent any air flow around the edges of the first air filter **208**, ensuring that contaminated air cannot bypass the first air filter **208**.

FIG. 3 also shows that the filter clamp **302** can include a clamping bar **306**. The clamping bar **306** is configured to move, allowing the clamping bar **306** to press the first air filter **208** against the sealing surface **304**. This pressure ensures, in turn, that air cannot pass between the sealing surface **304** and the first air filter **208**. The clamping bar **306** can pivot on one end (e.g., the rear) and move on the opposite end (e.g., the front), allowing the clamping bar **306** to rotate about the attachment point. Additionally or alternatively, the clamping bar **306** can include a portion which extends through one or more slots in the housing **102**, allowing the clamping bar **306** to move relative to the housing **102**.

FIG. 3 further shows that the clamping bar **306** can include a slot **308**. The slot **308** is configured to receive the second air filter **210**. I.e., the slot **308** ensures that the second air filter **210** remains in place relative to the first air filter **208**. The slot can extend along an entire surface of the housing **102** or can extend along only a part of the surface, forming tabs.

FIG. 3 additionally shows that the filter clamp **302** can include a lock **310**. The lock **310** is configured to hold the clamping bar **306** in place relative to the housing **102**. In particular, the lock **310** can ensure that the pressure on the first air filter **208** created by the clamping bar **306** remains steady and that the first air filter **208** remains pressed against the sealing surface **304**. I.e., the user places the first air filter **208** between the sealing surface **304** and the clamping bar **306**, presses the clamping bar **306** against the first air filter **208**, then locks the clamping bar **306** in place, preventing movement of the first air filter **208** and ensuring that contaminated air passes through first air filter **208**.

FIG. 4 illustrates an example of a baffle filter **400**. In at least one implementation, the baffle filter **400** can be used to collect large cooling mist droplets. For example, the baffle filter **200** can prevent straight line movement of the cooling mist. As the cooling mist comes in contact with the baffle filter **400** the cooling liquid condenses and is removed from the air.

FIG. 4 shows that the baffle filter **400** can include a first layer of baffles **402**. In at least one implementation, the first layer of baffles **402** are flow-directing or obstructing vanes or panels used to direct air flow through the baffle filter **400**. I.e., the first layer of baffles can include panels which cover a portion of the opening in which the baffle filter is placed.

FIG. 4 also shows that the baffle filter **400** can include a second layer of baffles **404**. In at least one implementation, the second layer of baffles **404** can be offset relative to the first layer of baffles **402**. Offsetting the second layer of baffles **404** relative to the second layer of baffles **402** can ensure that much of the air flow passes near either the first layer of baffles **402** or the second layer of baffles **404**. The closer the air flow passes to either the first layer of baffles **402** or the second layer of baffles **404** the more the cooling liquid will condense out of the air.

FIG. 5 illustrates an expanded view of an example of a mesh filter **500**. In at least one implementation, the mesh filter **500** can be used to collect smaller cooling liquid droplets. For example, the mesh filter **500** can include small openings

through which the cooling mist will flow. As the cooling mist comes in contact with the mesh filter **500** the remaining cooling liquid is removed from the air.

FIG. **5** shows that the mesh filter **500** can include a first layer of mesh **502**. In at least one implementation, the first layer of mesh **502** can include small openings through which the cooling mist can pass. I.e., the first layer of mesh **502** includes much smaller openings than the openings of a baffle filter, as disclosed above. Therefore, the cooling mist passes closer to the first layer of mesh **502** and smaller cooling liquid droplets can be collected.

FIG. **5** also show that the mesh filter **500** can include a second layer of mesh **504**. In at least one implementation, the second layer of mesh **504** can be offset relative to the first layer of mesh **502**. Additionally or alternatively, the second layer of mesh **504** can be rotated relative to the first layer of mesh **502**. Both offsetting the second layer of mesh **504** and rotating the second layer of mesh **504** relative to the first layer of mesh **502** can decrease the size of the opening through which the cooling mist will pass and, therefore, increase the amount of cooling liquid removed from the air.

FIG. **6** illustrates an example of an air filter **600**. In at least one implementation, the air filter **600** can remove one or more pollutants from the air. In particular, the air filter **600** can remove undesired particles from the air. The filtered air can be more suitable for breathing than unfiltered air.

FIG. **6** shows that the air filter **600** can include a filter material **602**. In at least one implementation, the filter material **602** can include any material which will remove the desired particles from the air. For example, the filter material **602** can include fibrous material such as cotton, foam, cloth, paper, fiberglass or any other desired material. Fibrous material can increase the surface area of the filter material **602**, increasing the filtering ability and decreasing the required width of the air filter **600**.

FIG. **6** also shows that the air filter **600** can include one or more pleats **604**. In at least one implementation, a pleat **604** (older plait) is a type of fold formed by doubling fabric back upon itself and securing it in place. I.e., a pleat **604** is a fold in the fabric where a surface is folded back to a point where it nearly touches itself. Providing one or more pleats **604** in the air filter can increase the surface area of the filter material **602**, thus increasing the filtering capability of the air filter **600**.

FIG. **7** is a flow chart illustrating a method **700** of removing a cooling liquid from a cooling mist. In at least one implementation, the method **700** can be performed by a mist collector, such as the mist collector **100** and other components of FIGS. **1-5**. Therefore, the method **700** will be described, exemplarily, with reference to the mist collector **100** and other components of FIGS. **1-5**. Nevertheless, one of skill in the art can appreciate that the method **700** can be used with a mist collector other than the mist collector **100** and other components of FIGS. **1-5**.

FIG. **7** shows that the method **700** can include receiving **702** a cooling mist **702**. In particular, many tools use a cooling liquid that is applied to either the work surface or some portion of the tool. The cooling liquid is configured to remove the heat caused by friction during the machining process. The machining process can, in turn, throw droplets of the cooling liquid into the air, creating a mist. For example, the cooling liquid can include water, antifreeze, oils, water soluble oil or any other desired cooling liquid.

In at least one implementation, receiving **702** a cooling mist can include bringing a cooling mist in through an intake **108**. In at least one implementation, the intake **108** can allow cooling mist to enter the housing **102**. I.e., the intake **108** can pull cooling mist into the housing, where the cooling liquid

will be removed from the cooling mist. Additionally or alternatively, the collected cooling liquid can pass back through the intake **108** to be used again by the machine tool.

FIG. **7** also shows that the method **700** can include passing **704** the cooling mist through a first mist filter. In at least one implementation, the first mist filter **202** can include any desired material. For example, the first mist filter **202** can include plastic or metal. The first mist filter **202** can collect larger mist particles. I.e., the first mist filter **202** can collect large droplets from the cooling mist. For example, the first mist filter **202** can include a baffle filter. A baffle filter can include a series of baffles that the cooling mist must pass through. Because there is not a straight line through the filter, larger particles are unable to make the turns required by the air flow and collects on the baffles.

In at least one implementation, the first mist filter **202** can be inclined relative to a horizontal position. Inclining the first mist filter **202** can allow the larger droplets which have been collect to travel down the filter, where they are collected and reused as cooling liquid for the machine tool.

In at least one implementation, a fan **212** can be used to pass **704** the cooling mist through a first mist filter. I.e., the fan **212** creates an air flow that draws cooling mist into the mist collector **100** through the first mist filter **202**, the second mist filter **204**, the first air filter **208**, the second air filter **210** and out the exhaust **110**.

FIG. **7** further shows that the method **700** can include passing **706** the cooling mist through a second mist filter. In at least one implementation, the second mist filter **204** can include any desired material. For example, the second mist filter **204** can include plastic or metal. The second mist filter can collect smaller mist particles. I.e., particles which are small enough to remain in the air flow and pass through the first mist filter **202** are collected by the second mist filter **204**. The second mist filter **204** can be inclined similar to the first mist filter **202**, allowing the collected cooling liquid to drain. Additionally or alternatively, the second mist filter **204** can be horizontal. Any droplets collected can form drops where collected which are allowed to drip onto the first mist filter **202** then collected and returned to the machine tool.

The second mist filter **204** can include any filter configured to receive smaller mist droplets. For example, the second mist filter **204** can include a mesh filter. In at least one implementation, a mesh filter can include one or more mesh layers. Mesh consists of semi-permeable barrier made of connected strands of material. I.e., mesh includes material with very small openings. As the cooling mist passes through the mesh filter, the cooling mist collects on the strands of material. Mesh layers can be offset relative to one another, eliminating straight lines of air flow. The more mesh layers present, the more droplets collected and the less droplets allowed to pass through the mesh filter; however, more mesh layers decrease the air flow through the mesh filter increasing the required pressure to circulate the cooling mist.

FIG. **7** additionally shows that the method **700** can include passing **708** the demisted air through a first air filter. In at least one implementation, the first air filter **208** can be configured to remove one or more pollutants from the air. For example, the first air filter **208** can include a carbon filter. Carbon filtering is a method of filtering that uses a piece of activated carbon to remove contaminants and impurities, utilizing chemical adsorption. Activated carbon, also called activated charcoal, activated coal or carbo activatus, is a form of carbon that has been processed to make it extremely porous and thus to have a very large surface area available for adsorption. One pound (454 g) of activated carbon contains a surface area of

approximately 100 acres. A carbon filter can be utilized to remove odors from the demisted air.

FIG. 7 also shows that the method 700 can include passing 710 the demisted air through a second air filter. In at least one implementation, second air filter 210 can remove additional air pollutants. For example, the second air filter 210 can include a particulate air filter. A particulate air filter is a device composed of fibrous materials which removes solid particulates such as dust, pollen, mold, and bacteria from the air. A particulate air filter can include foam, pleated paper, cotton, cloth or spun fiberglass filter elements. Additionally or alternatively, the second air filter 210 can include an ionizing filter. An ionizing filter, or ioniser, uses fibers or elements with a static electric charge, which attract dust particles.

One of skill in the art will appreciate that the first air filter and the second air filter can be combined with one another. For example, an ionizing filter may be able to remove both odor particles and larger particles from the air. Additionally or alternatively, the number of filters may be increased as needed to remove other pollutants or particles from the air.

FIG. 7 further shows that the method 700 can include removing 712 the demisted and filtered air. For example, the demisted and filtered air can be removed 712 through an exhaust 110. In at least one implementation, the exhaust 110 can allow clean air to exit the mist collector 100. I.e., the mist collector 100 will take in cooling mist through the intake 108, and pump out clean air, with the cooling liquid removed, through the exhaust 110. The exhaust 110 can connect to the machine tool, can be vented to the outdoors, or can be vented into the tool room, as desired by the user.

One skilled in the art will appreciate that, for this and other processes and methods disclosed herein, the functions performed in the processes and methods may be implemented in differing order. Furthermore, the outlined steps and operations are only provided as examples, and some of the steps and operations may be optional, combined into fewer steps and operations, or expanded into additional steps and operations without detracting from the essence of the disclosed embodiments.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. A system for removing cooling liquid from a mist, the system comprising:

an intake, wherein the intake is configured to receive the cooling mist;

a baffle filter including a plurality of overlapping and offset layers of baffles, the baffle filter configured to collect and output cooling liquid from the cooling mist;

a mesh positioned vertically above the baffle and configured to drip cooling liquid collected thereon onto the baffle filter;

an air filter, wherein the air filter is configured to remove a portion of pollutants from the demisted air;

a filter clamp configured to hold the air filter in place; and an exhaust, wherein the exhaust is configured to output the demisted air.

2. The system of claim 1, further comprising:

an output, wherein the output is configured to remove the cooling liquid from the system.

3. The system of claim 1, wherein the cooling liquid includes one of:

water;

antifreeze;

an oil; or

a water soluble oil.

4. The system of claim 1 further comprising:

a machine tool, wherein the machine tool uses the cooling liquid to reduce frictional heat of one or more parts of the machine tool.

5. The system of claim 1, wherein the filter clamp includes: a sealing surface configured to secure a first surface of the air filter;

a clamping bar configured to press the air filter against the sealing surface; and

a lock configured to secure the clamping bar in place.

6. A system for removing cooling liquid from a mist, the system comprising:

a housing;

a fan, wherein the fan is configured to move air through the system;

an intake, wherein the intake is configured to allow a cooling mist from the exterior of the housing to enter the interior of the housing;

wherein the cooling mist includes cooling liquid droplets suspended in air;

a mist filter, wherein the mist filter:

is configured to remove the cooling liquid from the mist; and

includes:

a first mist filter, wherein the first mist filter is configured to remove a portion of the cooling liquid from the cooling mist; and

a second mist filter, wherein the second mist filter is configured to:

remove the majority of the remaining cooling liquid from the cooling mist; and

drip the removed cooling liquid onto the first mist filter;

an absorbent layer configured to absorb unrecoverable oil in the demisted air;

an air filter, wherein the air filter includes:

a first air filter, wherein the first air filter is configured to remove a portion of pollutants from the demisted air; and

a second air filter, wherein the second air filter is configured to remove a portion of the pollutants not removed by the first air filter;

a filter clamp configured to hold the air filter in place relative to the housing, wherein the filter clamp includes:

a sealing surface configured to secure a first surface of the first air filter;

a clamping bar configured to press a second surface of the first air filter, pressing the first air filter against the sealing surface;

a slot configured to receive the second air filter; and

a lock configured to secure the clamping bar in place; and

an exhaust, wherein the exhaust is configured to output the demisted air.

7. The system of claim 6 further comprising a gauge, wherein the gauge is configured to indicate the state of the filters.

8. The system of claim 7, wherein the gauge includes a magnetohelic gauge.

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9. The system of claim 8, wherein the manometric gauge measures the difference between an input pressure and an output pressure.

10. The system of claim 6, wherein the first mist filter includes a metallic baffle filter.

11. The system of claim 6, wherein the second mist filter includes a metallic mesh filter.

12. The system of claim 6, wherein the first air filter includes a carbon filter.

13. The system of claim 6, wherein the second air filter includes a pleated air filter.

14. The system of claim 6, wherein the first mist filter is inclined relative to a horizontal position.

15. The system of claim 6 further comprising:
a door, wherein the door is configured to provide access to the mist filter and the air filter.

16. The system of claim 15 further comprising an attachment, wherein the attachment connects the door to the housing with an air tight seal.

17. A method for removing cooling liquid from a cooling mist, the method comprising:

receiving a cooling mist, wherein the cooling mist includes cooling liquid droplets suspended in air;

passing the cooling mist through a first mist filter, wherein the first mist filter removes a portion of the cooling liquid droplets from the air;

passing the cooling mist through a second mist filter, wherein the second mist filter removes a second portion of the cooling liquid droplets from the air to generate demisted air;

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dripping the second portion of the cooling liquid droplets onto the first mist filter;

outputting the first and second portions of the cooling liquid droplets from the first mist filter;

passing the demisted air through an air filter, wherein the air filter:

removes a portion of a desired pollutant from the demisted air; and

is secured using a filter clamp configured to hold the first air filter in place; and

outputting the demisted and filtered air.

18. The method of claim 17, wherein passing the demisted air through includes:

passing the demisted air through a first air filter, wherein the first air filter is configured to remove a portion of pollutants from the demisted air; and

passing the demisted air through a second air filter, wherein the second air filter is configured to remove a portion of the pollutants not removed by the first air filter.

19. The method of claim 17, wherein outputting the demisted and filtered air includes exhausting the air.

20. The method of claim 17, further comprising passing the demisted air through an absorbent layer and absorbing uncovered cooling liquid droplets in the demisted air prior to passing the demisted air through the air filter.

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